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| RESEARCH ARTICLE

SENMENT ANALYSIS ON SOFTWARE DEVELOPMENT STAGES AMONG MALE AND FEMALE LECTURERS TEACHING COMPUTER PROGRAMMING COURSES IN FEDERAL UNIVERSITIES SOUTH-SOUTH NIGERIA

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| ABSTRACT

The purpose of this study was to investigate the sentiments on software development stages among male and female lecturers teaching computer programming courses in Federal University South South Nigeria. Descriptive survey design was adopted for this study. The population for this study was 130 lecturers teaching computer programming courses in Federal Universities South South Nigeria. Total sampling technique was used to select the entire population. Five specific purposes were stated to guide the study, five research questions were raised in the study and five null hypotheses were formulated and tested in the study. Mean statistic was used to answer the research questions and independent t-test was used to test the null hypotheses at 0.05 level of significance. The instrument for data collection was questionnaire titled"sentiment analysis on software development stages questionnaire (SASDSQ)".The instrument was subjected to face validation by experts. Cronbach Alpha statistics was used to determine the reliability coefficient of the instrument which yielded 0.84. The results showed a sentiment gap between -1 to 1. Where value of the sentiment gap is zero(0), it indicates that there is no sentiment, that both male and female lecturers have the same logical reasoning on those items and where the sentiment gap is negative or positive, it indicates that there is sentiment and there is need to bridge the sentiment gaps on each of the items. Hypotheses revealed that there is a significant sentiment difference in the mean responses of male and female lecturers teaching computer programming courses in Federal Universities in South-South Nigeria. Based on these findings, it is therefore recommended among others that universities, management, professional agencies like Computer Society of Nigeria(CSN), Computer Regulatory council of Nigeria(CRCN) and other related agencies should organized workshops, seminars, interactive forum for lecturers to meet and share their experiences and sentiment in software development stages in order to harmonize the standards of software development among computing students in Federal Universities as well as developing software that adhere to global standard.

| KEYWORDS

Sentiment analysis, software development, computer programming, teaching

| INTRODUCTION

Sentiment analysis in software development simply means the perception of different developers or lecturers when teaching software development in Nigerian universities. Today in information and communication world, everything is done through the use of software. These software are being developed based on the individual ways of thinking or perceived way by which the design should be carried out. Essien (2018) pointed out that there is no standard way of developing and teaching software development

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stages except standard models that has been selected and adopted universally. Every other way of teaching the development stages depends on the lecturer's perception and understanding. This has led to the proliferation of software teaching methods. Some of the recommended materials in software development stages has diverse way of handling tasks. Software according to (Ubong *et al.,* 2024) is defined as a set of instructions and documentation that tells a computer what to do and how to perform a task. It is a set of programs, which is designed to perform a well defined function. A program is a sequence of instructions written to solve a particular problem. Software includes all different programs on computer such as operating system, web browsers, media player, games, and antivirus programs.

A software development stages can be defined as a set of activities, methods, practices and transformations that people use to develop and maintain software and the associated products (Saeed *et al.,* 2019). Organizations related to the software development should follow some kind of stages, which will allow the product to be delivered on time and with sufficient quality to satisfy both customer and end users (Giardino *et al.,* 2016). Software development stages are usually represented in a simplified form using software process models. Over the years, a wide range of models have been proposed, each with variable strengths, weaknesses, limitations and degree of success to manage a project efficiently, the manager or development team must choose the software development model that will work best for the project at hand. All models have different strengths and weaknesses and exist for different reasons. Davoudian and Mengchi (2020) observed that every software development which is internationally accepted evolve around data gathering, feature extraction, analysis model, validation and logic control, requirements analysis, object design, system design and many others. However, this work dealt on the five (2) stages..

Data gathering is the act of generating a list of requirements to define what a project is about and its goal. Insights can be gathered from the stakeholders, whether clients, employee users, consumers or vendors. Data gathering often acts as the blueprints of a project. Poorly established requirements can have a negative impact, while properly established ones can lead to success (Randall and Robert 2015). Requirement gathering is most often used in business, particularly around information technology (IT), and knowing about the two requirement types(Functional and Nonfunctional requirements) can help you in selecting a proper requirement gathering technique that best suites the project that is working on. Data can be gathered through one on one interview, questionnaire, brainstorming, group interview and so on. However, the requirements gathering can be influence by the sentiment of the developers.

An analysis model is a handwritten or digital model that describes the steps involved in developing software. Analysis models assist in giving the team and the client a visual depiction of the development process to examine (Maiti and Mitropoulos 2015) . In all the stages of software development, lecturers' sentiment come in to play during the teaching of software development and programming courses example Python, data science, HTML, Algorithm, introduction to MATLAB and others. Among the most straightforward and efficient software process models is the waterfall approach. Waterfall model makes the development process easy to follow by showing each stage as a distinct, sequential step. Kneuper (2018) opinioned that another popular type of software process model is prototyping, which is producing a working design quickly for the customer to make sure the team is adhering to their specifications. This helps the development team troubleshoot issues with the customer before moving forward with full development and gives

the customer an idea of what the final product might look like. According to Singh and Kaur (2017) the technique of segmenting the development phases into several parts in response to customer feedback is known as incremental development. The team works in small steps, finishing a section of the software and then sending it to users for review and input before proceeding to the next stage. Spiral model assists the team in identifying possible risks early in the project's development, these assessments enable quicker response times and more reasonable expectations for the client. Blincoe (2019) stated that the iterative model has similarities to the incremental model, with the exception that team members evaluate and provide feedback on specific software components prior to working on the remaining components

In the world of technology, computer programming courses have emerged as the cornerstone of modern software development. Computer programming courses are courses that equips learners with the skills and knowledge required to design, develop, and maintain software applications. (Passey,2017). Programming languages are the foundation for computer programmers, software developers, and software engineers. Specific language is used while writing programs in order to facilitate human reading and writing. The choice of the programming language depend on the understanding of the developer or the lecturer, this is where sentiment comes in to play. Learning programming courses are made harder by the way lecturers uses sentiment to approach it (Medeiro *et al.,* 2019). A lecturers may have fear or anxiety if there is uncertainty about the material to be taught or if there is lack of students' understanding of the subject matter example in coding. This can be seen in the lecturer's tone of voice which can convey a lot of information about their mood and attitude. For example, a lecturer who is enthusiastic about a topic might speak with more energy and excitement, while a lecturer who is frustrated or overwhelmed might speak more slowly or monotonously, a lecturer's body language can also convey their sentiments. This can affect student's understanding. Sentiment is also seen in the perception that male lecturers are more confident, experienced, exposed, authoritative and more professionals than female lecturers in teaching programming courses. (Apiah and Agbelevo 2015). This may be as a result of the fact that computer programming courses are male dominated, leading to the opinion that men are naturally suited for programming and software development.

To learn computer programming courses is to understand the fundamental ideas underlie the code (Yizhou and James 2017), instead of Memorization of the code which is not the most efficient approach to cultivate a programming mindset. Aside from sentiment, the difficulties of learning and understanding computer programming were also identified to be attributed to poor pedagogical methods, university tradition, poor study methods of learners, lack of problem solving abilities and low self-efficacy. Huang. And Looi (2020) pointed out that tackling these issues is to engage members of the software engineering community to aid in teaching the software engineering curriculum, drawing their practical experience to guide the content and the delivery of its constituent courses, helping to outline course content, having professional agencies to come in to give guest lectures or coaching, joining the staff to shape the curriculum for the next generation of software engineers, to give something back to the community. Having standard ways and methods of teaching programming for software development instead of using individual sentiment calls for this research.

| Statement of the Problem

The quality of teaching and learning software development during programming class continue to raise concerns due to the software

products produced by students at the end of their research work. Orges *et al.* (2010) opinioned that lecturer's adoption of approach in teaching computer programming courses and software development stages is based on their individual sentiments (opinions or perception) and this is the reason that software developed by students cannot meet the required standard for global adoption. Researches have shown opinionated points within development teams to be highly relevant for success of software projects. These opinions are paramount for the project team (in this case lecturers) to be aware of the positive and negative frame of mind within them as such awareness will enable appropriate intervention.

Sentiment analysis offers ways to determine the mood of the team (lecturers) based on textual communication by finding and extract the opinionated data on a specific stage of software development. It also help in determining the polarity (positive and negative) definition on the subject matter. It is against this background the research was conducted to investigate and identity the opinions of lectures teaching software development during programming classes in each stage of the process in order to find a common specific platform so that software products by students can be standardized.

| Purpose of the Study

The purpose of this study was to determine the sentiment on software development stages among lecturers teaching computer programming courses in Federal Universities South South Nigeria, Specifically the study sought to determine:

i. The sentiment on data gathering stage among male and female lecturers during the teaching of computer programming courses in Federal Universities South South Nigeria.

ii The sentiment on analysis model stage among male and female lecturers during the teaching of computer programming courses in Federal Universities South South Nigeria.

| Research Questions

The following research questions were raised to guide the study:

i. What is the sentiment on data gathering stage among male and female lecturers during the teaching of computer programming courses in Federal Universities South-South Nigeria?

ii What is the sentiment on analysis model stage among male and female lecturers during the teaching of computer programming courses in Federal Universities South-South Nigeria?

| Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.

i. There is no significant difference in the mean responses between male and female lecturers' sentiment on data gathering stage during the teaching of computer programming courses in Federal Universities South- South Nigeria.

ii. There is no significant difference in the mean responses between male and female lec0turers' sentiment on analysis model stage during the teaching of computer programming courses in Federal Universities South- South Nigeria

| RESEARCH METHOD

This study employed descriptive survey design. The area of this study was South –South Zone of Nigeria. The South-South Zone is one of the six geopolitical zones in the Nigeria. Population of this study consisted 130 lecturers from the eight federal universities in south south teaching computer science majoring in programming discipline between the period 2022/2023 academic session. The instrument tagged "sentiment analysis on software development stages questionnaire" was used in collecting data for the

study. The Instrument was subjected to face validation. Cronbach's Alpha statistical tool was used to determine the reliability of the instrument and the response yielded the reliability coefficient of 0.84. The high reliability index made the instrument suitable for the study. The questionnaire was administered on the respondents by the researcher through research assistants who were briefed on the purpose of the study. Mean was used to answer the research questions while related t test was used to test the null hypothesis at 0.05 level of significance. Where the value of sentiment gap is zero (0), it indicates that there is no sentiment and both male and female computer programming lecturers have agreed on the same logical reasoning and that items on those stages of software development should be maintained. Where value of the sentiment gap is negative or positive, in indicates that there is sentiment or not too much variation, between male and female computer programming lecturers. In testing the null hypothesis, the p-value of the test was compared with the alpha value (level of significance) of 0.05. When the p- value is less than or equal to the alpha value ($p \leq 0.05$) the null hypothesis (Ho) is rejected otherwise maintained.

RESULTS AND DISCUSSION OF FINDINGS

Research Question 1

What is the sentiment on data gathering stage among male and female lecturers during the teaching of computer programming courses in South South Nigeria?

Table 1: Sentiment Gap Analysis on data gathering stage among male and female lecturers during the teaching of computer programming courses in Federal Universities South South Nigeria

S/N	Data Gathering Sentiment	Gender	n	Mean	Sentiment gap	Remarks
1	I feel satisfied gathering data using online interview	Male Female	90 34	3.28 3.56	-0.28	S
2	Feedback on previous work is a good source of data gathering.	Male Female	90 34	3.24 3.01	0.23	S
3	Questionnaire is one of the best way to gather data from clients.	Male Female	90 34	3.32 4.01	-0.69	S
4	I prefer face to face interaction with customers during data gathering.	Male Female	90 34	3.73 3.76	-0.03	S
5	I am not thrilled when using inspection as data gathering method.	Male Female	90 34	3.49 4.01	-0.52	S
6	Feasibility Study is crucial in data gathering.	Male Female	90 34	3.04 3.03	0.01	S
7	I like to use specification document in data gathering.	Male Female	90 34	3.03 3.50	-0.47	S
8	I am delighted with goal directed data collection.	Male Female	90 34	3.02 3.01	0.01	S
9	Experience is an important aspect in data gathering.	Male Female	90 34	3.28 3.56	-0.28	

10	I am happy when I combine different methods of data gathering.	Male	90	3.03	0.02	S
		Female	34	3.01		
	Overall sentiments	Male	90	3.245	-0.2	S
		Female	34	3.446		

Key: S=sentiment, Source: Field Work (2025)

The results in Table 1 indicated that items 2, 6, 8 and 10 have their sentiment gaps to fall between 0.01 to 0 which shows positive sentiment. And also items 1, 3, 4, 5, 7, and 9 have their sentiment gaps to fall between -0.28 to -0.6 which shows negative sentiment. The overall sentiment between male and female lecturers shows negative which have a sentiment gap of-0.2. This results shows that there is negative sentiment on data gathering stage among male and female lecturers during the teaching of computer programming courses in Federal Universities in South- South, Nigeria. This implies that there is need to bridge the gap between male and female lecturers on each of the items

Research Question 2

What is the sentiment on analysis model stage among male and female lecturers during the teaching of computer programming courses in Federal Universities South South Nigeria?

Table 2: Sentiment Gap Analysis on analysis model stage among male and female lecturers during the teaching of computer programming courses in Federal Universities South South Nigeria

S/N	Analysis Model Sentiment	Gender	n	Mean	Sentiment gap	Remarks
1	I feel happy in using architectural analysis model.	Male	90	3.02	0.01	S
		Female	34	3.01		
2	Descriptive analysis is the best model.	Male	90	1.89	0.13	S
		Female	34	1.76		
3	Mathematic analysis does not incorporate real world examples.	Male	90	3.17	-0.57	S
		Female	34	3.74		
4	I feel enthusiastic when using hand on activities in applying models.	Male	90	3.24	0.03	S
		Female	34	3.21		
5	It is challenging to explain complex analysis model.	Male	90	3.06	-0.96	S
		Female	34	4.02		
6	I think the best time to choose project model is during requirement analysis.	Male	90	3.93	-0.08	S
		Female	34	4.01		
7	I prefer creating interface immediately after functionality has been established.	Male	90	3.01	0.00	NS
		Female	34	3.01		
8	The choice of hardware must be taken into account in analysis model.	Male	90	3.08	-0.66	S
		Female	34	3.74		
9	It can be challenging to select the best software process model for the project.	Male	90	2.53	-0.49	S
		Female	34	3.02		
10	Understanding the requirement lead to a proper selection of the process model.	Male	90	3.03	0.02	S
		Female	34	3.01		
	Overall sentiment	Male	90	2.996	-0.257	S
		Female	34	3.253		

Key: S= Sentiment, NS=No Sentiment Source: Field Work (2025)

The results in Table 2 indicated that items 1, 2, 4 and 10 have their sentiment gaps to fall between 0.01 to 0.13 which shows positive sentiment, Items 3, 5, 6, 8, and 9 have their

sentiment gaps to fall between - 0.08 to -0.96 which shows negative sentiment. Also items 7 have its sentiment gap to be zero (0) which shows no sentiment. The overall sentiment between male and female lecturers is negative which have a sentiment gap of -0.257. This results shows that there is negative sentiment on analysis model stage among male and female lecturers during the teaching of computer programming courses in Federal Universities in South- South, Nigeria. This implies that there is need to bridge the gap between male and female lecturers on each of the items.

Research Hypothesis I

There is no significant difference in the mean responses between male and female lecturers' sentiment on data gathering stage during the teaching of computer programming courses in Federal Universities South South Nigeria.

Table 3: t-test analysis on the difference in the mean response between male and female lecturers' sentiment on data gathering stage during the teaching of computer programming courses in Federal Universities South South Nigeria

S/N	Data Gathering Sentiment	Gender	n	Mean	SD	t-cal	P<.05	Remarks
1	I feel satisfied gathering data using online interview	Male	90	3.28	.450	-2.99	.003	S
		Female	34	3.56	.504			
2	Feedback on previous work is a good source of data gathering.	Male	90	3.24	.432	3.29	.002	S
		Female	34	3.01	.090			
3	Questionnaire is one of the best way to gather data from clients.	Male	90	3.32	.470	8.388	.001	S
		Female	34	4.01	.090			
4	I prefer face to face interaction with customers during data gathering.	Male	90	3.73	.469	-.339	.002	S
		Female	34	3.76	.431			
5	I am not thrilled when using inspection as data gathering method.	Male	90	3.49	.546	5.449	.001	S
		Female	34	4.01	.090			
6	Feasibility Study is crucial in data gathering.	Male	90	3.04	.207	.377	.002	S
		Female	34	3.03	.171			
7	I like to use specification document in data gathering.	Male	90	3.03	.278	6.525	.001	S
		Female	34	3.50	.508			
8	I am delighted with goal directed data collection.	Male	90	3.02	.148	.872	.003	S
		Female	34	3.01	.090			
9	Experience is an important aspect in data gathering.	Male	90	3.28	.450	.613	.005	
		Female	34	3.56	.504			
10	I am happy when I use different methods of data gathering.	Male	90	3.03	.181	.074	.0025	S
		Female	34	3.01	.090			

S=Significant, df =122, Sig @p<.05 Source: Field Work (2025)

Table 3 gives the summary of the t-test analysis of the difference in the mean response between male and female lecturers teaching computer programming in Federal Universities South South Nigeria. The result shows that the p-values ranged from 0.001 to 0.005 at 122 df, since all the p-values were lower than the 0.05alpha level, it implies that there is significance difference between the mean response of the male and female lecturers on data gathering sentiment on software development stages. Hence the research hypothesis which stated that there is no significance difference in the mean responses between male and female lecturers on data gathering sentiment in teaching computer programming in Federal Universities South South Nigeria is rejected.

Research Hypotheses III

There is no significant difference in the mean responses between male and female

lecturers' sentiment on analysis model stage during the teaching of computer programming courses in Federal Universities South South Nigeria.

Table 4: t-test analysis on the difference in the mean response between male and female lecturers' sentiment on analysis model stage during the teaching of computer programming courses in Federal Universities South South Nigeria

S/N	Analysis Model Sentiment	Gender	n	Mean	SD	t-cal	P<.05	Remarks
1	I feel happy in using architectural analysis model.	Male	90	3.02	.148	.872	.005	S
		Female	34	3.01	.090			
2	Descriptive analysis is the best model.	Male	90	1.89	.409	1.487	.006	S
		Female	34	1.76	.431			
3	Mathematic analysis does not incorporate real world examples.	Male	90	3.17	.375	-7.136	.001	S
		Female	34	3.74	.448			
4	I feel enthusiastic when using hand on activities in applying models.	Male	90	3.24	.432	.449	.002	S
		Female	34	3.21	.410			
5	It is challenging to explain complex analysis model.	Male	90	3.06	.998	-5.502	.001	S
		Female	34	4.02	.148			
6	I think the best time to choose project model is during requirement analysis.	Male	90	3.93	.292	-1.327	<.001	S
		Female	34	4.01	.146			
7	I prefer creating interface immediately after functionality has been established.	Male	90	3.01	.105	.613	.001	S
		Female	34	3.01	.105			
8	The choice of hardware must be taken into account in analysis model.	Male	90	3.08	.308	-9.293	<.001	S
		Female	34	3.74	.448			
9	It can be challenging to select the best software process model for the project.	Male	90	2.53	.502	-5.410	<.001	S
		Female	34	3.02	.148			
10	Understanding the requirement lead to a proper selection of the process model.	Male	90	3.03	.181	1.074	.001	S
		Female	34	3.01	.105			

S=Significant, df =122, Sig @p<.05 Source: Field Work (2025)

Table 4.4 gives the summary of the t-test analysis of the difference in the mean response between male and female lecturers on analysis model in teaching computer programming in Federal Universities South South Nigeria. The result shows that the p-values ranged from < 0.001 to 0.006 at 122 df, since all the p-values were lower than the 0.05 alpha level of significance, it implies that there is significance difference between the mean response of the male and female lecturers on analysis model sentiment on software development stages. Hence the research hypothesis which stated that there is no significance difference in the mean responses between male and female lecturers on analysis model sentiment in teaching computer programming in Federal Universities South South Nigeria is rejected

| Discussion of Findings

The result of findings in Table 1 shows that there is negative sentiment on data gathering stage among male and female lecturers during the teaching of computer programming courses in Federal Universities in South- South, Nigeria. There is need to bridge the gap in each of the items. The corresponding t-test analysis in Table 3 indicated that there is a significant difference in mean responses between male and female lecturers' sentiment on data gathering stage during the teaching of computer programming courses in Federal Universities South South Nigeria. The difference maybe as a result of the fact that male and female lecturers may have different experience and understanding of structured data gathering methods like surveys, interviews and automated data collection tools. The result is in line with the finding of Zan *et al.* (2016) who said that different data gathering techniques have

different impact on software development life cycle. The result is also supported by the finding of Raymond *et al.,* (2017) who showed that Engineers do not necessarily have much expertise in data gathering and easy use of tools to produce concise output.

The result of findings in Table 2 shows that there is negative sentiment on analysis model stage among male and female lecturers during the teaching of computer programming courses in Federal Universities in South- South, Nigeria. The corresponding t-test analysis in Table 4 indicated that there is a significant difference in mean responses between male and female lecturers' sentiment on analysis model stage during the teaching of computer programming courses in Federal Universities South South Nigeria

This finding is supported by the finding of Shyle (2017) who showed that the developer's model depends on the understanding and purpose of the software project. This finding is also supported by Alban and Redion (2022) who seek the usage of knowledge gain from the different models could be used by students in software industry. This difference in the lecturers' sentiment could be as a result of the fact that male and female lecturers reason logically different on the items on analysis model. Addressing this difference in analysis model using architectural model, descriptive analysis model, mathematics model, interface creation, the choice of hardware and understanding of requirement requires equal training opportunities and interactive forum where lecturers meet and share their experiences and sentiment in analysis model.

| CONCLUSION

Conclusions were drawn based on the findings of this study on Sentiment Analysis on Software Development Stages among Lecturers during the teaching of Computer Programming Courses in Federal Universities South South Nigeria. The results shows that there is negative sentiment on identified items on data gathering, feature extraction, analysis model, logic control and positive sentiment on the items on data validation stage. When tested, the result further revealed that there is a significant difference between the mean response of male and female lecturers in all stages of software development. Therefore, computer programming lecturers in Federal Universities should come together to share their knowledge, experience and sentiment on software development stages in order to have a standardize software development stages to teach students to be able to create standardized software.

| RECOMMENDATIONS

Based on the outcome of the mean analysis it is observed that there was sentiment gap that falls between -1 to 1 which indicate weak sentiment or not too much variation between male and female computer programming lecturers. It is therefore recommended that universities, management, professional agencies like Computer Society of Nigeria (CSN), Computer Regulatory council of Nigeria (CRCN) and other related agencies should organized workshops, seminars, interactive forum for lecturers to meet and share their experiences and sentiment in software development stages in order to harmonize the standards of software development among computing students in Federal Universities as well as developing software that adhere to global standard.

Students should be exposed to the practical application of each stage, making the learning experience engaging and hand-on as positive sentiment suggests that the students value the stages when effectively taught.

Curriculum reviews should be conducted to ensure that these stages are woven together to give students a comprehensive understanding of the software development.

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